MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	27
Submission Date	2/23/01
Status (open/closed/deferred)	CLOSED
Last Action Date	5/24/01

Short Title for Change Issue:	Benefits of Including Heading and Airspeed in State Vector Report

MASPS Document Reference:		Originator Information:	
Entire document (y/n)	yes	Name	Richard Barhydt, NASA
Section number(s)	2.1.2.2, 2.1.2.2.2.1, 3.4.3.1	Phone	(757) 864-2065
Paragraph number(s)		E-mail	r.barhydt@larc.nasa.gov
Table/Figure number(s)	3-5	Other	Intent Subgroup, WG4

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
X	ASA MASPS
	TIS-B MASPS
X	UAT MOPS
	Item needed to support applications that have well defined concept of operation
X	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
X	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description:

Including heading and airspeed information in the state vector report would greatly improve the effectiveness and efficiency of a variety of current and future applications. When both the air and ground vectors are provided, current wind conditions encountered by the transmitting aircraft can be determined. The current heading and airspeed provide additional situation awareness benefits for nearby aircraft.

Three applications are presented as examples to show the benefits of heading and airspeed information: paired approaches, precision FMS procedures, and trajectory prediction following a turn.

Paired Approaches (primary goal - increase airport capacity):
- Trailing aircraft is to cross runway threshold at specified time after leading aircraft.
- Time spacing behind lead aircraft based on each aircraft's desired final approach speed and wind.
- Wind affects spacing because it changes the amount of time in which the differences in final approach speeds act to close or stretch the gap between aircraft.
- Wind may vary significantly with altitude.
- Current wind models are often sporadic and out-dated.
- Near real-time wind encountered by preceding aircraft would lead to better predictions, thereby reducing the probability of a missed approach and increasing airport capacity.

Issue Description (continued):

Airspeed information allows pilots to compare an aircraft's actual speed with its expected speed. Differences may provide pilots with advanced knowledge of conflicts or potential wind-shear events.

Precision FMS Procedures (primary goal - increase throughput)
- Current Air Traffic Management procedures often impose waypoint speed and altitude constraints.
- FMS descent path based on aircraft performance and wind.
- Unknown wind conditions require thrust and speedbrake inputs from pilot in order to meet waypoint constraints, leading to higher crew workload and lower fuel efficiency.
- Accurate wind information will become even more important for future FMS procedures expected to require higher degree of precision (time constraints, vertical tunnels, and others).

Trajectory Prediction Following a Turn (possible goal - conflict detection)
- After an aircraft completes a turn, its groundspeed is unknown.
- Current wind conditions encountered by the transmitting aircraft would allow its groundspeed after the turn to be computed.
- Conflict detection routine could determine whether other aircraft's turn creates or resolves a conflict.

Note: Additional supporting material is contained in Working Paper 242A-WP-3-05.

Originator's proposed resolution if any:

The current version of DO-242 is ambiguous in whether airspeed and heading information are included in the state vector report. These parameters are clearly listed as required elements (if they are available) in the State Vector Report Definition (Table 3-5). Other parts of the document pertaining to the state vector refer to heading and airspeed as backup information (Section 3.4.3.1) or neglect to mention them at all (2.1.2.2, 2.1.2.2.1).

We propose that the referenced sections be changed to clarify that heading and airspeed are part of the state vector report and are to be broadcast along with north and east velocity, provided they are available.

If available bandwidth is a limiting issue, the possibility of alternating between the air and ground-referenced velocity vector should be investigated.

Note: Additional supporting material is contained in Working Paper 242A-WP-3-05.

Ad Hoc Group Deliberations:

April 6, 2001: This Issue Paper was discussed by the ad hoc group at their April 2001 meeting. It was agreed that a new Issue Paper would be written to consolidate all Issue Papers related to Air-reference velocity vectors. When this Issue Paper is approved by the group, this is paper and IP28 will be closed.

May 24, 2001: This Issue Paper was reviewed by the ad hoc group at their May 2001 meeting. It was agreed that this IP will be CLOSED, since IP37 – which will be addressed in Revision A – has been approved which consolidates all material on air-reference velocity vectors from IPs 27, 28, and 242A-WP-4-07.